

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions of claims in the application.

Listing of Claims

Claim 1 (currently amended): A resist pattern thickening material comprising:

a resin;

a crosslinking agent;

at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, ~~an alcohol surfactant,~~ and an ethylene diamine surfactant; and

pure water,

wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant, ~~and a secondary alcohol ethoxylate surfactant~~ and

wherein the resist pattern thickening material is capable of thickening a resist pattern of ArF resist.

Claim 2 (original): A resist pattern thickening material according to Claim 1, wherein the cationic surfactant is at least one of an alkyl cationic surfactant, an amide quaternary cationic surfactant, and an ester quaternary cationic surfactant.

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Claim 3 (original): A resist pattern thickening material according to Claim 1, wherein the amphoteric surfactant is at least one of an aminoxide surfactant and a betaine surfactant.

Claim 4 (cancelled)

Claim 5 (original): A resist pattern thickening material according to Claim 1, wherein the resist pattern thickening material has at least one of water-solubility and alkali-solubility.

Claim 6 (original): A resist pattern thickening material according to Claim 1, wherein the resin is at least one of polyvinyl alcohol, polyvinyl acetal, and polyvinyl acetate.

Claim 7 (original): A resist pattern thickening material according to Claim 1, wherein the resin contains polyvinyl acetal in an amount of 5% by mass to 40% by mass.

Claim 8 (original): A resist pattern thickening material according to Claim 1, wherein the crosslinking agent is at least one of a melamine derivative, a urea derivative, and an uril derivative.

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Claim 9 (original): A resist pattern thickening material according to Claim 1, further comprising a water-soluble aromatic compound.

Claim 10 (original): A resist pattern thickening material according to Claim 9, wherein a solubility of the water-soluble aromatic compound is 1 g or more thereof in 100 g of water of 25°C.

Claim 11 (original): A resist pattern thickening material according to Claim 9, wherein the water-soluble aromatic compound has at least two polar groups.

Claim 12 (original): A resist pattern thickening material according to Claim 11, wherein the polar groups are each independently selected from hydroxyl groups, carboxyl groups, and carbonyl groups.

Claim 13 (original): A resist pattern thickening material according to Claim 9, wherein the water-soluble aromatic compound is at least one of a polyphenol compound, an aromatic carboxylic acid compound, a naphthalene polyhydroxy compound, a benzophenone compound, a flavonoid compound, a derivative thereof, and a glycoside thereof.

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Claim 14 (original): A resist pattern thickening material according to Claim 1, further comprising a resin containing an aromatic compound in a portion thereof.

Claim 15 (original): A resist pattern thickening material according to Claim 14, wherein the resin containing an aromatic compound in a portion thereof is at least one of a polyvinyl aryl acetal resin, a polyvinyl aryl ether resin, and a polyvinyl aryl ester resin.

Claim 16 (original): A resist pattern thickening material according to Claim 14, wherein the aromatic compound in the resin containing an aromatic compound in a portion thereof has at least one functional group of a hydroxyl group, an amino group, a sulfonyl group, a carboxyl group, and a derivative thereof.

Claim 17 (original): A resist pattern thickening material according to Claim 14, wherein the resin containing an aromatic compound in a portion thereof has an acetyl group.

Claim 18 (original): A resist pattern thickening material according to Claim 14, wherein a molar content of the aromatic compound in the resin containing an aromatic compound in a portion thereof is 5 mol% or more.

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Claim 19 (original): A resist pattern thickening material according to Claim 1, further comprising an organic solvent.

Claim 20 (original): A resist pattern thickening material according to Claim 19, wherein the organic solvent is at least one of an alcohol solvent, a chain ester solvent, a cyclic ester solvent, a ketone solvent, a chain ether solvent, and a cyclic ether solvent.

Claim 21 (currently amended): A resist pattern comprising:

- a first layer of ~~[[a]]~~ an ArF resist material, the first layer having a pattern; and
- a second layer formed of a resist pattern thickening material, formed on the first layer, the resist pattern thickening material comprising:
 - a resin;
 - a crosslinking agent;
 - at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, ~~an alcohol surfactant~~, and an ethylene diamine surfactant; and
 - pure water,
- wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant, ~~and a secondary alcohol ethoxylate surfactant~~.

Claim 22 (currently amended): A resist pattern according to Claim 21, wherein the resist material is at least one selected from the group consisting of ~~a novolak resist, a polyhydroxystyrene (PHS) resist,~~ an acrylic resist, a cycloolefin - maleic acid anhydride resist, a cycloolefin resist, and a cycloolefin - acryl hybrid resist.

Claim 23 (currently amended): A process for forming a resist pattern, comprising:
forming a first layer of ~~[[a]]~~ an ArF resist material; and
applying a resist pattern thickening material onto the first layer to thicken the first layer,
wherein the resist pattern thickening material comprises:
a resin;
a crosslinking agent;
at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant
selected from an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, ~~an~~
~~alcohol surfactant,~~ and an ethylene diamine surfactant ; and
pure water,
wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a
lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant, ~~and a secondary~~
~~alcohol ethoxylate surfactant.~~

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Claim 24 (original): A process for forming a resist pattern according to Claim 23, wherein a developing process is carried out after the step of applying the resist pattern thickening material.

Claim 25 (original): A process for forming a resist pattern according to Claim 24, wherein the developing process is carried out by using pure water.

Claim 26 (currently amended): A semiconductor device comprising:
a pattern formed by using:
a first layer of ~~[[a]]~~ an ArF resist material; and
a second layer of a resist pattern thickening material formed on the resist material,
wherein the resist pattern thickening material comprises:
a resin;
a crosslinking agent;
at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant
selected from an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, ~~an~~
~~alcohol surfactant~~, and an ethylene diamine surfactant; and
pure water,
wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a
lauryl alcohol ethoxylate surfactant, an oleyl alcohol ethoxylate surfactant, ~~and a secondary~~
~~alcohol ethoxylate surfactant~~.

Claim 27 (currently amended): A process for manufacturing a semiconductor device comprising:

forming a first layer of ~~[[a]]~~ an ArF resist material on an underlying layer, the first layer having a pattern;

applying a resist pattern thickening material on the first layer; and

etching a portion of the underlying layer where the first layer is not formed,

wherein the resist pattern thickening material comprises:

a resin;

a crosslinking agent;

at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, ~~an alcohol surfactant,~~ and an ethylene diamine surfactant; and

pure water,

wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant, ~~and a secondary alcohol ethoxylate surfactant.~~

Claim 28 (original): A process for manufacturing a semiconductor device according to Claim 27, further comprising:

applying a surfactant on the surface of the resist pattern to be thickened, before the step of applying the resist pattern thickening material.

Claim 29 (new): A resist pattern thickening material comprising;

a resin;

a crosslinking agent;

at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, and an ethylene diamine surfactant, at an amount of 1.25 to 2.5 weight parts with respect to 100 parts of the resin; and

pure water,

wherein the alkoxylate surfactant is at least one of an octyphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant.

Claim 30 (new): A resist pattern thickening material according to claim 29, wherein the resist pattern thickening material is capable of thickening a resist pattern of ArF resist.